



AIR PHOTO MAPPING,
INTERPRETATION AND
ANALYSIS FOR ALL
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Western Lake District Air Photo and LiDAR Mapping Project

Project Report
V 1.1

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SUMMARY

The Western Lake District Air Photo and Lidar Mapping Project was funded by National Grid through the auspices of the Lake District National Park Authority. The work was undertaken by Alison Deegan between May and August 2016 with the support of Lake District National Park Authority and Historic England.

Archaeological features ranging in dates from the Neolithic to the mid-20th century that were visible on air photos and/or lidar imagery as cropmarks, soilmarks and earthworks and, in certain cases, as structures were drawn as seen on maps and linked to text-based monument records. This work was undertaken according to the scope and standards of Historic England's National Mapping Programme.

A variety of sources were consulted by this project including over 300 verticals, mostly taken from non-archaeological purposes and approximately 134 obliques that were mostly taken to record archaeological sites and historical buildings. Digital ortho-photography, covering the whole of the project area and Light Detection and Ranging (LiDAR) data, covering approximately 76% were also examined. The information from these various sources, combined with data from existing monument records and historical Ordnance Survey maps was consolidated into a layer of GIS mapping and 159 monument records. The monument records and mapping can be accessed via the relevant HER. The records can also be accessed online through Historic England's [Pastscape](#) website.

The area of this project was dictated by the requirements of the client, National Grid and the coverage of previous NMP-standard projects. It comprises an irregular area of 27 whole kilometre squares on the coastal plain between Holmrook and Kirksanton. The Survey Area takes in small areas of fell but does not extend to the coast.

Most of the features mapped and recorded by this project date to the post medieval period or later. The prehistoric, Roman and medieval periods are represented by a relatively small number of monuments, some previously known. There are also a handful of monuments of 20th century date.

Project Name	Western Lake District Air Photo and LiDAR mapping Project
LDNPA HER Event UID	2057
NRHE Event UID:	1582205
NRHE Measured Drawing:	MD001386
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Project author:	Alison Deegan
Report author	Alison Deegan

1 INTRODUCTION

1.1 Project Background

This report concerns the Western Lake District Air Photo and LiDAR Mapping Project.

The Western Lake District Air Photo and Lidar Mapping Project was funded by National Grid and supported by the Lake District National Park Authority and Historic England. The work was undertaken by Alison Deegan between May and August 2016 to the scope and standards of Historic England's National Mapping Programme (NMP).

NMP-standard projects are generating a comprehensive record of the archaeology that is visible on air photographs for large areas of England. As of June 2016 approximately 50% of the country had been covered by NMP-standard projects.

1.2 Geographical Background

The project area of 27km² lies mostly within the Lake District National Park but a small area is under the authority of Cumbria County Council (c. 1.75km²) (see Figure 1). The area is irregular in shape, but covers whole kilometre squares to allow easy integration with existing and future NMP-standard projects. The area is continuous with the exception of a single kilometre square that lies 4km to the north of the main body of the project, near Holmrook.

The project area lies within the West Cumbria Coastal Plain National Character Area (NCA), as defined by Natural England. It does not, however incorporate any part of the coastal strip, this having been covered by an earlier project: the North West Rapid Coastal Assessment (Johnson 2009, fig 2.1). The project area also clips the fringes of the Cumbria High Fells NCA.

The project area is undulating with a general east to west fall to approximately 20m OD but it also includes some abrupt rises to around 250m OD onto Black Combe Fell and 170m on Lacra Bank. The project area is crossed by several rivers that flow westward to the Irish Sea: the broad valley of Witham Beck, which separates Black Combe and Lacra Bank, the River Annas and further north the more convoluted and wood-fringed springs and becks that feed the River Esk. The discrete kilometre square lies between the Rivers Irt and Mite.

The land is predominantly rural in character, pastoralism predominates but with small areas of arable and some uncultivated ground. The villages are small and linked by the A595 and the Whitehaven to Furness railway line skirts around the Fells through this area.

The lower flanks of the mudstone Black Combe Fell are mainly under moorland whilst Lacra Bank, with its tuff formation bedrock is under upland pasture. As a consequence the character of the two are quite different.

1.3 Archaeological Background

In relation to other NMP-standard projects this area abuts the North-West Rapid Coastal Zone Assessment (NWCZA) to the west and parts of the Cumbrian Terrestrial Minerals Resource Assessment (CTMR) to the north and to the south-east (see Figure 2, Johnson 2009, Deegan 2013).

A small number of archaeological events and interventions have taken place within this project area. Some of the area's megaliths were documented by J. Eccleston in 19th century and investigations undertaken at Lacra in 1947 included partial excavation of several of the small stone circles (Eccleston 1870, Dixon and Fell 1948). Fieldwalking activity in the area has produced a considerable body of Mesolithic to Bronze Age lithics, particularly around Eskmeals (eg Cherry 1969). In 1992 archaeological excavations took place in fields to the south of Bootle in advance of the laying of a British Gas pipeline, these uncovered a cremation burial in an area of cropmarks (see Event1186).

Of the later periods the only significant investigation appears to be that of a medieval pottery kiln at Muckleground (Cherry and Cherry 1969).

Pennington's analysis of the pollen and other deposits at Barfield Tarn, which lies near the centre of the project area has considerable significance for this and the wider environs (Pennington 1970, Forster 2010).

Three monuments within the project area have Scheduled Monument status: Lacra Old Kirk (List Entry no.102188), Great Knott Stone Circle (List Entry no.1009122) and Giant's Grave (List Entry no.1009486).

1.4 Method Summary

In general this project recorded archaeological features dating from the Neolithic to the mid-20th century that were visible on the aerial imagery as cropmarks, soilmarks, earthworks and, in some cases, as structures. The archaeological scope broadly mirrors the NMP Sphere of Interest (Winton 2016, Section 5). The main aspects that are pertinent to this particular project and any divergence from it are summarised in [Appendix 1](#).

This project utilised print and digital air photos and LiDAR imagery together with existing

monument records and historical Ordnance Survey maps. Initially three collections of air photographs were identified as containing source material for this project: Historic England Archive (HEA), Cambridge University Collection of Aerial Photography (CUCAP) and Cumbria Historic Environment Record (CHER). Unfortunately, due to the closure of the library, the CUCAP material was not accessible during the lifetime of the project and so was not consulted. The Lake District National Park Authority (LDNPA) also holds some vertical and oblique coverage of the Survey Area and this was consulted. The holdings for these are summarised in Table 1 below and further details are given in [Appendix 2](#).

Collection Name	Quantity consulted	
	oblique air photos	vertical air photos
Historic England Archive	61	c. 260
Cumbria Historic Environment Record	52	19
Lake District National Park Authority	21	27
Total	134	306

Table 1. Air photo collections and summary of material consulted (some photographs are duplicated between collections)

The vertical air photographs were taken by the Royal Air Force, Meridian Air Maps Ltd, Ordnance Survey and ADAS for military, civil engineering, cartographic and environmental purposes rather than to record archaeological sites. However many of these images do show earthwork features and they cover all parts of the project area on several occasions from the mid 1940s to the 1990s. The oblique air photographs, mostly taken specifically for archaeological purposes, were sparsely distributed.

Geo-referenced 25cm resolution colour digital air photos produced by Bluesky International/Get Mapping Plc were supplied through Air Photos Great Britain as georeferenced 1km² tiles. Imagery captured in 2008 was available for each kilometre square, and 2014 imagery was also available for most of the project area.

Environment Agency LiDAR data was available for approximately 76% of the overall project area. This data was available at a range of resolutions and only the highest resolution data was examined for any given area: 50cm resolution data was available for 2.5km², 1m resolution data for 16km² and a further 2.3km² had only 2m resolution coverage (see Figure 2). The Digital Terrain Models (DTM) and the Digital Surface Models (DSM) were both processed as 16-direction hill-shaded models, and where necessary as views lit from a single direction. The

DSM models were examined first and the DTM were consulted where the land cover made it useful to do so, for example in areas of woodland.

The print air photographs were examined under magnification and stereoscopically where possible. Photographs selected for transcription (rectification and mapping) were then scanned at 400 dpi, and output as uncompressed TIFF format images (.TIF).

Scanned images were rectified using the specialist software AERIAL5.36. Control information was mostly derived from the Ordnance Survey MasterMap™ 1:2500 scale vector maps, which were also used as a base for mapping. Accuracy for the Ordnance Survey raster 1:2500 maps is in the range of $\pm 2\text{m}$ and acceptable tolerance for rectification of photographs is generally $\pm 2.5\text{m}$.

The rectified air photographs and digital imagery, including the LiDAR outputs were then collated in the GIS (MAPINFO Professional 12.5) where the archaeological features were digitised into a mapping layer. Ditched, banked and structural features were depicted with detailed polygons that depicted their width and shape. Earthwork slopes were depicted with a T-hachure convention indicating the top and direction of slope. Ridge and furrow was mapped with an outline to indicate the extent of the land or block and an annotated with an arrow to show the direction of the plough furrows.

There are three strands to the project's recording strategy: the creation of new or the enhancement of existing monument records in the NRHE, the creation of new or the enhancement of existing monument records in the Lake District National Park's Historic Environment Record and the addition of object data to the map objects in the GIS. The content of the GIS object data is listed in [Appendix 3](#) and enables the management and interrogation of the map data.

2 PROJECT RESULTS

2.1 Overview

For the NRHE this project generated 144 new monument records and enhanced or amended 15 existing monument records. It created 126 new Lake District National Park HER records and 11 existing records. For those monuments lying outside of the park, 7 have existing representation in the Cumbria HER and a further 18 will be new to that HER.

This section provides a brief overview of some of the results of this project by period. References to Lake District National Park HER are provided in brackets eg (23599). Any references to NRHE monument records are prefixed with NRHE.

2.2 Neolithic and Bronze Age

There are rich pockets of known and potential Neolithic and Bronze Age sites within the project area.

Air photos taken in the late 1980s and/or early 1990s revealed a cluster of three unusual enclosures in fields to the south of Bootle (61395). These enclosures are curvilinear in plan and measure between 45m and 65m in diameter. They are defined by a ditched circuit, seen as near continuous cropmarks in one example but more fragmentary in the others (Figure 3). The significant characteristic of all three enclosures is the presence of an internal array of pits, all concentric to the outer ditch, all off-set approximately 3-4m from the outer ditch and each spaced 5-6 from the next (in so far as they are visible on the air photos). The air photos show an open pipeline trench and easement cutting across the more northerly of the enclosures. Archaeological investigations carried out along this British Gas pipeline uncovered a Bronze Age urn from a central pit within a small mound and ditch (R. Holbrey pers comm). Another ring ditch, 17m in diameter, is visible as a cropmark on the north-east side of the same enclosure (13967). This would suggest, though certainly not prove, that these enclosures were in use in the Bronze Age.

A similar ditch and pit defined enclosure has been revealed by recent reconnaissance nearby at Gutterby (13965). This monument lies just outside the area but has been mapped and recorded by this project (Figure 3). The Gutterby example is curvilinear in plan and measures approximately 53m by at least 37m. The internal pits are slightly closer to the ditch with an offset of 1-3m, and the spacing between the visible pits is approximately 8m. Interestingly this enclosure appears to be overlain by a broad-ditched D-shaped enclosure that may be of Iron

Age or Roman date.

Recent reconnaissance has also revealed a pit array within a previously-known curvilinear enclosure at Salthouse, Millom (NRHE1491102). This enclosure is defined by a ditch with a wide east facing that looks out over the Duddon Estuary. There are pits just inside the ditch terminals marking either side of the entrance and other pits around the inner edge of the enclosure. These lie closer to the ditch than the Gutterby and Bootle examples and are spaced approximately 10-14m apart, in so far as they are visible on the air photos.

All three sites are located on the low lying coastal plain between the sea and the higher ground. The Bootle examples overlook the broad valley floor of the River Annas, the Gutterby example overlooks the Mosses and the Millom example lies at the edge of Millom Marsh and the estuarine mudflats of the Duddon Estuary. Whilst these locations offer access to coastal, wetland and moorland resources, this can be said for most locations within West Cumbria Coastal Plain NCA.

These sites are clearly different to the pit-defined enclosure excavated further up the Cumbrian coast at Plasketlands (Bewley 1993, Fig 2). Here the pits were closely spaced (less than 1m apart), the post-packing indicates they held substantial timber uprights and the gaps between them could have been easily spanned to create an effective barrier.

Looking further afield very few monuments with the characteristics of the Bootle and Gutterby enclosure can be found in the records. A substantial Late Neolithic to Early Bronze Age 'pit circle' excavated at Boscombe Down is slightly larger at 63m in diameter and pits spaced 3-4m apart (<http://www.wessexarch.co.uk/projects/wiltshire/boscombe/ritual-landscape-boscombe-down>). At Lochbrow, Dumfries and Galloway, an oval enclosure measuring 60x45m is defined by pits approximately 6m (Millican 2007 Table 1). Neither share the coastal location or the external ditch of this project's examples. Whilst the wide spacing between the pits of all these examples suggests they were not designed to form a physical barrier, the Boscombe Down excavations suggest that not all the pits there would have even held timber posts. Whilst a few larger pits had ramps that would have helped with the insertion of large timbers others contain stone tools, ceramics and bone and some placed deposits.

Across England there are several examples of henge monuments that have an internal pit circuit, including Bow Henge in Devon, West Akeld Steads, Milford North Henge both Northumberland and Arminghall Henge, Norfolk, but with their very broad ditches, and small interiors these are of quite different relative proportions to the Bootle and Gutterby examples. Closer in layout are the Aubrey Holes at Stonehenge, a series of pits placed just within the

inner bank at intervals of approximately 5m. Thirty four of the Aubrey Holes have been excavated and many contained cremations (from Scheduled Monument List Entry 1010140).

Returning to the area of this project, field walking and intrusive investigations have demonstrated the importance of the coastal plain during the Mesolithic, Neolithic and Bronze Age periods (Hodgson and Brennand 2006, 25 & 33). Flint scatters of mainly Mesolithic date have been recovered from the vicinity of Eskmeals Pool, though this particular concentration may owe a lot to the pattern of fieldwork (see Figure 4). Interestingly a number of axe/hammer have been recovered from the area around the Bootle enclosures lending weight to their being an expression of Neolithic activity. There is a well-known concentration of stone circles and standing stones on the higher ground at Lacra (eg NRHE 37323 & 37317), but also some examples on the plain: the Giants Grave near Kirkstanton (NRHE 37326), the now-destroyed Annaside stone circle (NRHE 37038), another at Monks Foss (1474) and standing stones at Hall Foss (NRHE37265). Each lies close to a beck or stream flowing down from Black Combe.

Intriguingly there are two possible curvilinear enclosures lying close to the Giant's Grave standing stones (NRHE 1604243 and 1604204). Although no date has been ascribed to these cropmarked features they are as likely to be of Neolithic or Bronze date as any other. Similarly a shallow curvilinear earthwork at Moor House Farm (61375) may be of Neolithic and Bronze Age though perhaps is more likely to be the remains of a small waterbody, which would also have significance for the prehistoric environment.

Some environmental context for the construction of the megaliths, the deposition of the flint scatters and stone tools and possibly the development of these various curvilinear enclosures comes from a pollen sequence reconstructed from Barfield Tarn. This tarn lies just to the south of the River Annas, with the fell edge approximately 800m to the east and the present coastline 2km to the west. The Bootle enclosures lie 1km to the north of the tarn and the Gutterby example less than 3km to the south. Pennington notes that before 3000 B.C. (uncalibrated) indicators of soil erosion and a steep fall in elm and oak pollen suggest that the surrounding area had been cleared for cultivation (1970:69).

2.3 Iron Age and Roman

There is a paucity of monuments that can be attributed to the Iron Age or Roman period within the project, particularly in comparison with the earlier periods, and surprising given the proximity of Glannoventa, the Roman fort at Ravenglass. This dearth does however reflect the existing archaeological record: a Roman votive statuette from the Bootle area is the only

tangible find from the area (3425).

There are no dated monuments of these periods within the Survey Area, a consequence of the lack of archaeological excavation. The D-shaped enclosure that overlies the pit and ditch-defined enclosure at Gutterby (13965) may be of Iron Age or Roman date. This cropmarked site lies on a slight ridge between the sea and lower ground now known as The Mosses, with Black Combe beyond.

It is also possible that the curvilinear enclosures recorded as cropmarks around Giant's Grave, near Kirksanton are of Iron Age date (NRHE 1604243 and 1604204).

Extensive multi period earthworks survive on Lacro Bank and Great Knott, many are the result of post medieval cultivation but two areas to the south of Lacro Farm may have significance for the later prehistoric periods (see Figure 5). The better preserved group comprises a row of three enclosures on a west facing slope lying 200m south-west of Lacro Farm (NRHE37331). These enclosures are defined by low banks and the largest measures 28x23m. Closer to the disused farm there are series of very low earthworks that are highlighted by parched grass on some air photos (NRHE1604284). These appear to be the remains of a hollow way, small rectilinear enclosure and a large sub-circular enclosure. Unfortunately there is no LiDAR coverage of either of these two sites. These may have later prehistoric origins but a medieval date cannot be discounted on the meagre evidence available.

2.4 Medieval

Lacro Bank again offers the most likely remains of medieval settlement. Aside from the two possible and undated site mentioned above there are the remains of third settlement site on the north-west side of Lacro Farm. It comprises of two or more adjacent buildings at the edge of one of two small fields [NRHE37320]. The remains are low earthworks and possibly grassed over stonework and the field's boundaries have been partly reused for the extant field system. This farmstead may be associated with a series of lynchets that run across a broad gully a little to the east. The farmstead, fields and lynchets are encroached by later ridge and furrow of likely post medieval date. Again is it unfortunate that there is no LiDAR coverage of this area to elucidate further on the nature and inter-relationships of these earthworks. Also on Lacro Bank, on the west side of the old farmstead there is an area of broader plough ridges and possible plough headlands and banks that may have medieval origins [NRHE1604279 & 1604282].

This project recorded earthworks on land adjacent to Seaton Hall. This 16th century hall was

built on the site of a Benedictine nunnery and incorporates some fragments of the original fabric. The nunnery, originally known as Seton or Lekeley, was founded in the late 12th century (Wilson (ed) 1905, 192-194). Some of the earthworks (1479), in particular the fish pond may be contemporaneous with the nunnery and if so would have provided vital resources to what was an impoverished community (Wilson (ed) 1905, 192-194). Other features, including a channel that diverts water from the River Annas, may be designed landscape features associated with the post medieval hall. North of the hall post medieval narrow ridge and furrow appear to run across the remains of lynchet which may be of medieval origin (61439).

Looking at the overall Survey Area most of the ploughing remains that are visible on the air photos and LiDAR imagery would seem to be of post medieval origin. The plough furrows are straight and the ridges are less than 6m wide, and in some cases considerable narrower. However hints of earlier cultivation have been recorded at some locations including on Laca Bank (discussed above), around Hyton Farm (61376), near Inmans Farm (61373), south of Baldmire (61480), at Carleton Hall (61380) and in fields to the south of Bootle (61400). Broad plough ridges near Mill Wood at Broad Oak (61423), which are oriented northwest to south-east appear to be cut by post medieval narrow ridge and furrow on a near east to west alignment (61420).

2.5 Post medieval to late 19th century.

As mentioned above a considerable proportion of the cultivation ridges recorded by this project are likely to be of post medieval origin. In addition many of the linear features that are visible as levelled and earthwork banks, ditches and scarps and more occasionally as low walls are likely to be the remains of post medieval field boundaries. However many elements of the post medieval rural landscape: the farms, the fields and the lanes are extant and are still in use and so are beyond the recording remit of this project. Hence the record as told by the cropmarks and earthworks for the post medieval period is a very fragmented.

Remains around Barfield, near Bootle, provide a microcosm of the post medieval rural landscape (13536). The site is located between the River Annas and Barfield Tarn, just above the beck that flows from the latter into the former (see Figure 6). A farm still operates at Barfield, now much modernised even compared to its former 1960s self. The earthworks themselves hint at a diverse range of activities. Land to the south and west is under cultivation ridges, some encompassing a series of narrow and sharply-defined terraces of unknown purpose. Land to the north and west is divided into a series of small fields or paddocks, some

with extant walls, some with earthwork banks. One of these small plots contains the ruins of a barn and a neat arrangement of mounds that are thought to be the remains of an uprooted orchard. The barn appears to post-date the 1867 Ordnance Survey map.

To the immediate north of the farm and on the very edge of the beck's banks is a small building, earthworks and the 1867 Ordnance Survey maps show that this structure was associated with a water channel that ran alongside the beck almost as far back as Barfield Tarn. This points to the building's use as a water mill. A trackway leads from the north side of the farm down to the River Anna's flood plain, the course of the river and other drainage (61414) is clearly much altered but the date of this management is not certain.

The 1867 Ordnance Survey maps shows that orchards were a common feature at many farms in this area, but there are relatively few tangible remains of those that have been removed. An arrangement of mounds within a small enclosure at Inman's Farm (61378), like the Barfield example is not depicted on the historical maps but may be the remains of an uprooted fruit trees. At Old Hyton and Wood House the partial boundaries of former orchard that were depicted on the old maps are visible as earthworks (61401 & 61475).

There are a small number of other mill site within the Survey Area; the mill buildings are beyond the scope of this project and have not been mapped but mill races, ponds and dams have been depicted and recorded at Whitbeck Mill (12235) and Stainton Mill (61419), where they are visible. Near Kirksanton a long mill race (NRHE1604290) diverted water from Whicham Beck to feed the mill at Kirksanton. In the late 19th century this channel may also have carried water pumped out from the Whicham Iron Ore mine.

The Whicham Iron Ore mine [NRHE1604207] developed in the 1880s and is depicted on the 1900 Ordnance Survey map. It comprised a series of buildings or structures that covered the shaft heads, housed the mine machinery and ancillary facilities and some outlying shafts. The mine was linked to the mainline railway by a tramway. By 1945 the air photos show that the tramway and many of the buildings had already been removed.

Other extractive industries of this period, mainly targeting gravel are relatively small scale.

2.6 20th century

The 20th century remains that have been recorded by this project fall into two groups: features constructed for military or defensive purposes and the extractive industries.

The Camp at Wellbank Hall (61498) was built in the early 1940s to accommodate workers from

the Royal Ordnance Factory at Hycemoor (just beyond the area of this project) (<http://www.royalnavyresearcharchive.org.uk/FAA-Bases/Wellbank.htm#.V6RvCCKrEko>). In 1943 it was commissioned as H.M.S. Macaw, a Royal Navy Training Camp and then returned to the Ministry of Supply after the war. Recent air photos show that a few elements of this camp were still standing at the time.

In an area near Whicham Hall, now mostly obscured by Toppingmoss Plantation a complex network of ditches, a trackway and the remains of two structures are visible on historical air photos. These are the remains of a naval decoy (61489). This was one of a series of decoys built to simulate the port of Barrow in Furness and so deflect enemy bombing of the Royal Navy installations that were sited there. (Dobinson 2000a, 272)

The remains of a second and lesser known decoy has been identified by this project at Stangah (61411). Post war air photos show small circular earthworks and the site of huts in a small field to the west of the farm. The purpose of this site is revealed in a contemporary account

‘Since the aerodrome at Haverigg near Millom was likely to be an aerial target, a decoy was built in a field of the Stangrah Farm near Whitbeck. One could see it from the train between Bootle Station and Millom with its inflated rubber planes and mock hangers and heaps of inflammable stuff between them.’ Hepper 2011, 37

A radar beacon, standing within an octagonal blast Wall, together with a generator house and other features are visible in air photos taken in 1946 near How End (61418). Dobinson has identified this site as a Very High Frequency (VHF) Fixer site and an element of the early 1950s Rotor network, which was developed in a response to the Cold War threat (Dobinson 2000b 164, Dobinson and Thomas 2003, 87). Rotor was a network of existing and upgraded radar stations. Evidently How End was an upgraded Second World War installation as it is visible on the 1946 air photos.

There are large scale extractions at Waberthwaite (61444) and at Stangah (61412 & 61413), these have been recorded not so much for their heritage value but rather as a record of where the condition any earlier monuments will have been significantly compromised.

3 DATA ARCHIVING AND DISSEMINATION

3.1 Project Archive

The results of this project's mapping and interpretation are provided to the Lake District National Park Authority as two MapInfo tables, one containing the detailed mapping the other containing polygons that outline the extent of each corresponding HER record. An ESRI shape file format version of this data will be deposited with the Historic England via the Aerial Survey and Investigation team. Shape files for the area of the project that lies outside of the park will be provided to Cumbria HER.

The records resulting from this project are contained within and are integral to both the NRHE and the Lake District HER. The former may also be accessed online via Pastscape (www.pastscape.org.uk).

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APPENDIX 1 SPHERE OF INTEREST

Summarised from Winton 2016 and explicated in reference to this project.

Cropmarks, parchmarks, soilmarks

All sub-surface archaeological remains were recorded when visible as cropmarks, parchmarks or soilmarks.

Earthworks

All archaeological earthworks that are visible on aerial photographs or LiDAR imagery were recorded. This includes features visible as earthworks on early photographs but which have subsequently been levelled.

Buildings and Structures

All foundations of buildings visible as cropmarks, soilmarks, parchmarks, earthworks or ruined stonework were recorded as were standing roofed or unroofed buildings that were not depicted on any of the late 19th and 20th century Ordnance Survey maps. This allowed for the detailed mapping of certain military installations in the Survey Area.

Ridge and Furrow

All medieval and post medieval ridge and furrow and narrow ridge and furrow was mapped using the standard NMP conventions. No prehistoric rig was identified by this project.

Post Medieval Field Boundaries

If they were depicted on the historical Ordnance Survey maps, post medieval field boundaries, whether seen as cropmarks, earthworks, or still extant were generally not mapped. However where they were not depicted by the Ordnance Survey or where it was considered possible that such features had earlier origins then post medieval field boundaries were mapped and recorded by this project.

Parkland, Landscape Parks, Gardens and Country Houses

There were no significant sites of this category within the Survey Area.

Industrial Features and Extraction

Small local use quarries were recorded and all quarries of all dates up to the most recent air

photos were depicted. Infrastructure and buildings that were associated with industrial activities but now demolished were mapped. Extant mill buildings were not mapped but mill races, dams and ponds were recorded where seen.

Transport

The Sphere of Interest suggests that transport features such as canals and railways should not be recorded by NMP if they are depicted on historic Ordnance Survey maps. This project did however record former tramways associated with an industrial site.

Urban areas

This was not relevant to this project but refer to Winton 2016 if required.

20th Century Military Features

All visible First and Second World War as well as Cold War features were recorded.

Natural features

All natural features which are geological or geomorphological in origin are excluded. However where there was ambiguity over the origin of a cropmark or earthwork then the feature was mapped and recorded as (MONUMENT TYPE)/NATURAL FEATURE and expanded upon in the record text.

APPENDIX 2 AIR PHOTO COLLECTION DETAILS

Historic England Archive (HEA) (formerly National Monuments Record): The Engine House, Fire Fly Avenue, Swindon, SN2 2EH. The vertical, specialist oblique and military oblique air photographs held by the EHA were made available to this project in loan no. 99236.

Cambridge University Collection of Aerial Photography (CUCAP) collection: University of Cambridge, Air Photograph Library, Sir William Hardy Building, Tennis Court Road, Cambridge CB2 1QB. This collection was identified as a source in the project design. However when an application to borrow the relevant material was made it transpired that collection was closed to external users.

Cumbria HER (CHER): Historic Environment Team, County Offices, Kendal, Cumbria, LA9 4RQ. CHER holds a collection of oblique and vertical air photographs. This collection is a mix of duplicates of CUCAP and EHA-held material and unique photos taken by Tim Gates and others.

This collection was consulted towards the end of the project when mapping and recording from other sources had been completed. These photographs were checked against the project's mapping and records and amendments and additions were made as necessary.

Lake District National Park Authority: Murley Moss, Oxenholme Road, Kendal, Cumbria LA9 7RL. This HER holds a small number of vertical air photos of the Survey Area. It also has low resolution scan copies of two cropmarked sites within the area, and made these available to the project, the whereabouts of the original prints are not known.

APPENDIX 3 MONUMENT DATA (GIS)

The Monument Data table consists of 12 data fields. These are associated with and specific to each graphical element in a monument depiction.

Field name	Field content	Sample data
EHLAYER*	Name of NMP layer to which the object belongs	BANK, DITCH, EXTENT OF FEATURE, RFARROW, RFOUTLINE, MONUMENT POLYGON, STRUCTURE, THACHURE
NRHE_UID	NRHE Unique Identifier (UID)	1234567
HER_UID	Corresponding monument record in the Lake District National Park HER	12345
PERIOD	Date of features (EH Thesaurus)	LATER PREHISTORIC
TYPE	Monument type (EH Thesaurus)	ROUND HOUSE (DOMESTIC)
EVIDENCE	Form of remains as recorded on the source photograph (EH Thesaurus)	CROPMARK
PHOTO1	Reference for the primary source photograph and its date of photography	MAL/68025 V 69 25-APR-1968
LIDAR	If the monument could be detected on the LiDAR-derived images the relevant tile reference was recorded here.	LIDAR SD0987 Environment Agency 1m DSM XX-XXX-XXXX
LIDAR EVIDENCE	Condition of the monument as suggested by the latest available photos or LiDAR-derived images (this field may be blank if EVIDENCE was CROPMARK)	LEVELLED EARTHWORK
PHOTO2	Reference for the most recent photograph from which LATEST CONDITION was deduced (this field may be blank if the EVIDENCE was cropmark or latest condition relied on the evidence of the LiDAR-derived images.)	Next Perspective APGB Imagery SD1481 27-JUL-2014
LATEST CONDITION*	Condition of the monument as suggested by the latest available photos or LiDAR-derived images (this field may be blank if EVIDENCE was CROPMARK)	LEVELLED EARTHWORK

APPENDIX 4 PERIOD TERMS INDEXED BY THE PROJECT

PREHISTORIC	MEDIEVAL
LATER PREHISTORIC	POST MEDIEVAL
NEOLITHIC	20TH CENTURY
BRONZE AGE	EARLY 20TH CENTURY
IRON AGE	MID 20TH CENTURY
ROMAN	SECOND WORLD WAR
MEDIEVAL	UNCERTAIN

APPENDIX 5 SITE TYPE TERMS INDEXED BY THE PROJECT

ADIT	OVAL ENCLOSURE
BANK (EARTHWORK)	PIT
BARN	PIT DEFINED ENCLOSURE
BLAST WALL	PLATFORM
BOMBING DECOY	PLOUGH HEADLAND
BOUNDARY	POND
BUILDING	QUARRY
BUILDING PLATFORM	RADAR BEACON
CIRCULAR ENCLOSURE	RECTILINEAR ENCLOSURE
COMMAND HUT	RECUMBENT STONE
CURVILINEAR ENCLOSURE	RIDGE AND FURROW
DAM	RING DITCH
DECOY AIRFIELD	ROAD
DITCH	ROBBER TRENCH
ENCLOSURE	ROUND BARROW
EXTRACTIVE PIT	ROYAL OBSERVER CORPS SITE
FARM BUILDING	SAND AND GRAVEL EXTRACTION SITE
FARMSTEAD	SCARP
FENCE	SHAFT
FIELD BOUNDARY	SHEEP FOLD
GENERATOR HOUSE	SPOIL HEAP
GRAVEL PIT	STANDING STONE
HA HA	STONE CIRCLE
HOLLOW	STRUCTURE
HOLLOW WAY	SUB CIRCULAR ENCLOSURE
IRONSTONE MINE	TERRACE
LIME KILN	TERRACED GROUND
LIMESTONE QUARRY	TRACKWAY
LYNCHET	TRAMWAY
MILL POND	VHF FIXER STATION
MILL RACE	WALL
MOUND	WATER CHANNEL
NARROW RIDGE AND FURROW	WATER MILL
NATURAL FEATURE	WATERCOURSE
ORCHARD	WOOD

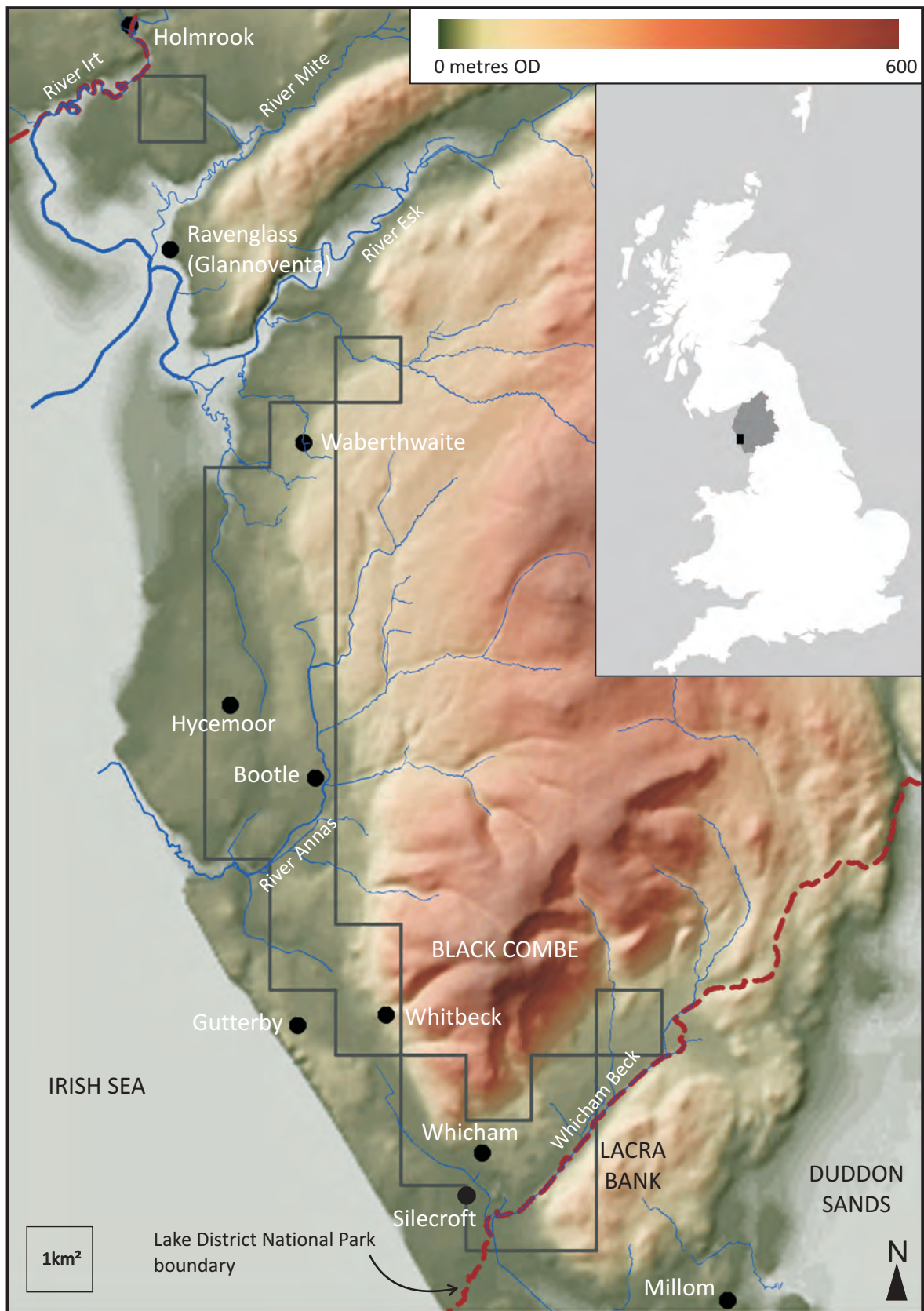


Figure 1. Location of the Western Lake District AP and LiDAR Mapping Project.

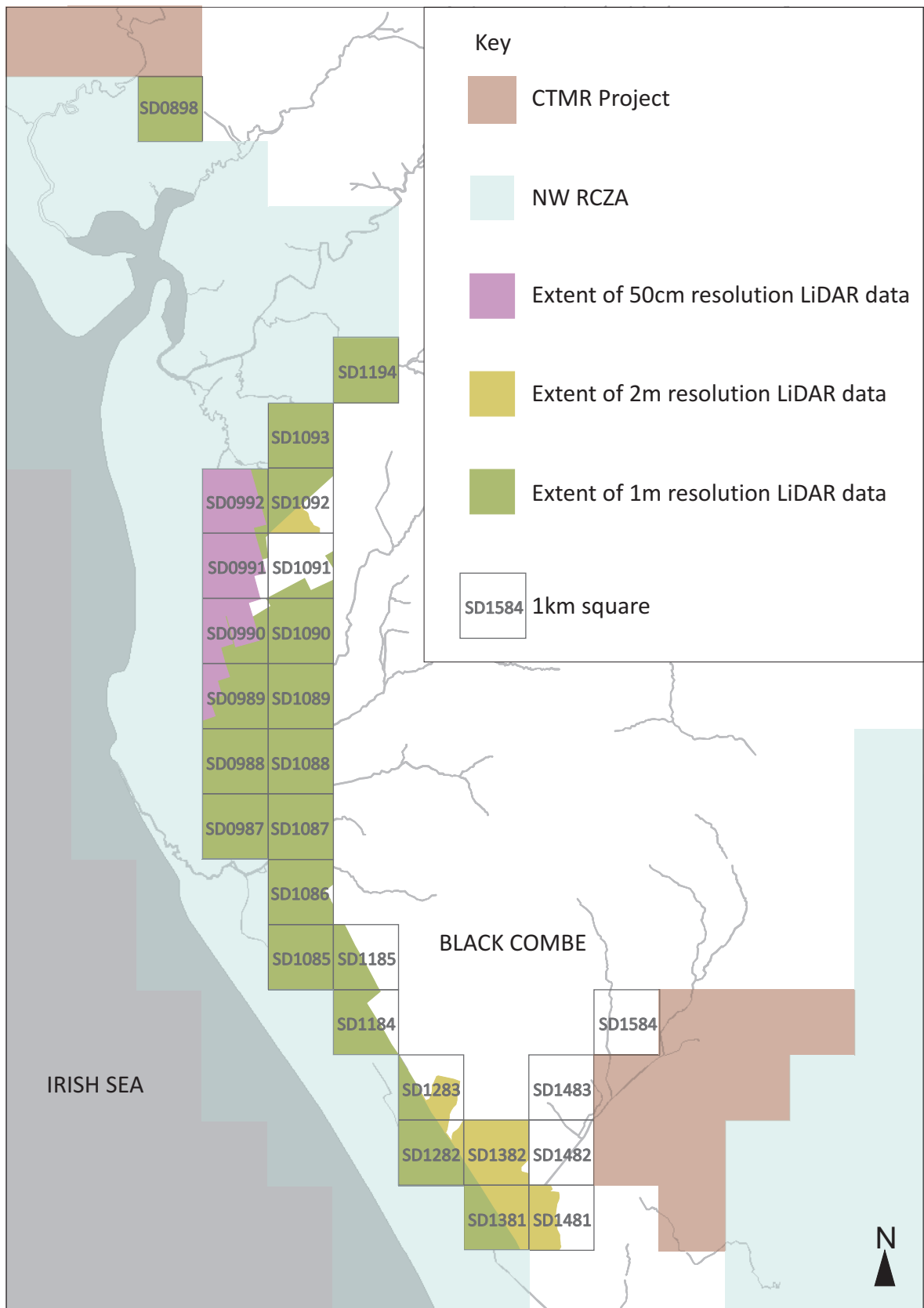


Figure 2. Overview of the available Environment Agency LiDAR coverage and other NMP-standard projects in the area.

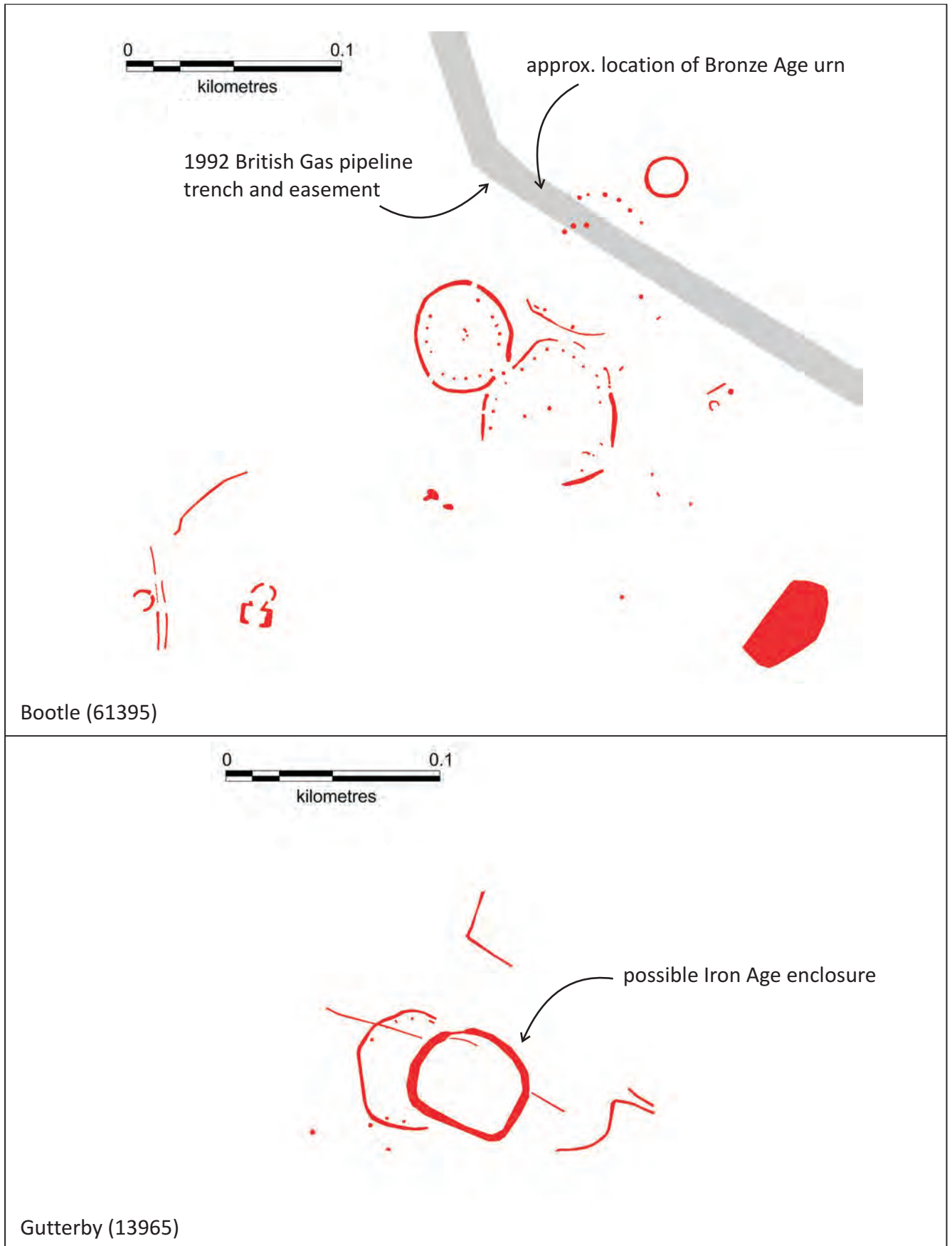


Figure 3. Extract from air photo and LiDAR mapping showing possible Neolithic/Bronze Age curvilinear enclosures with internal pit circuits.

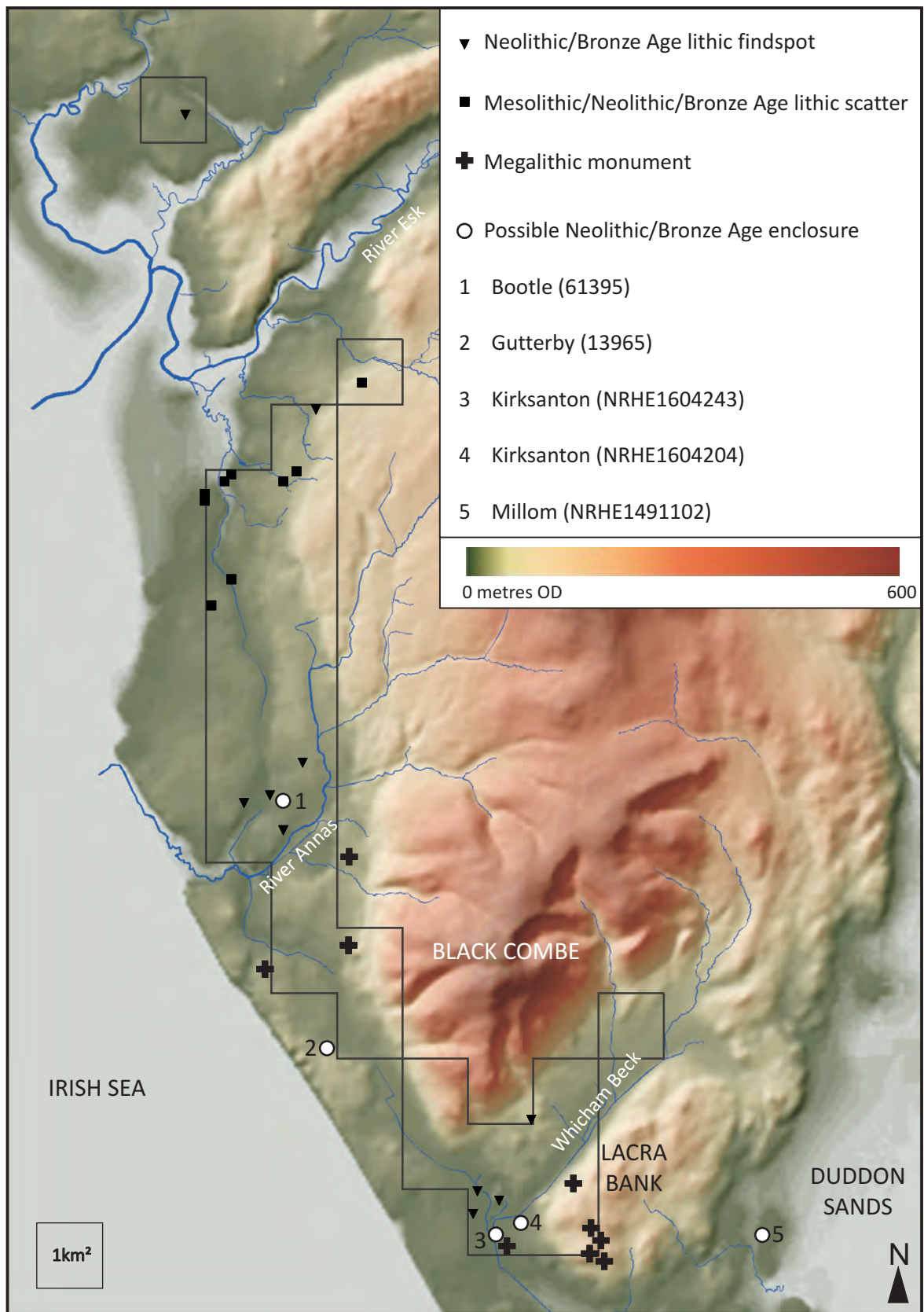


Figure 4. Distribution of Mesolithic, Neolithic and Bronze Age lithic sites, megaliths and enclosures in the project area.



Figure 5. Air photo looking west across the old farm at Lacre. Low undated earthworks at the centre of the image and on the centre left of the image may be the remains of Iron Age or Roman enclosures, though other dates may also be applicable. © Historic England Archive NMR 17190/54 24-AUG-1998



Figure 6. Air photo looking west across recent farm buildings at Barfield. The remains of post medieval ridge and furrow and terraces can be seen to the fore of the farm. A series of circular mounds between the farm and the beck may be the remains of an orchard. The ruined building on the banks of the beck is a former water mill. © Historic England Archive NMR 17163/2 24-Aug-1998